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DIRECTORATE OF STRATEGIC HUMAN RESOURCE COORDINATION

DOR(CAM) RESEARCH NOTE RN2000/03

A METHODOLOGY FOR MODELLING FAMILIES OF MILITARY OCCUPATIONS TO FORECAST ATTRITION

by

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June 2000

OTTAWA, CANADA

National Defence Défense nationale

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ABSTRACT

As Project Director for the retention portion of the Defence Planning Guidance (DPG) Change Objective 6.1 "Recruitment and Retention", the Director Military Employment Policy (DMEP) requested that DSHRC carry out a historical analysis of military attrition and forecast what attrition is likely to be in the future. DMEP requested that the analysis be conducted in "nests" of related military occupations (MOCs) rather than by individual MOC. This report describes the methodology being used for this study.

The methodology is illustrated with an example - the Air Technical Non Commissioned Member (NCM) MOCs. In this example, the Air Technical NCM MOCs were first modelled individually and the attrition forecasts combined by weighting them in proportion to the population of each component MOC. These results compare favourably with those obtained by using a "nest" model approach.

RÉSUMÉ

L'objectif de changement 6.1 du Guide de planification de la Défense (GPD) est intitulé «Recrutement et maintien» et le Directeur – Politique d'emploi militaire (DPEM) est le directeur de projet chargé de l'aspect concernant le maintien de l'effectif. À ce titre, il a demandé au DSRHC de mener une analyse historique de l'attrition militaire et de tenter de prédire ce que sera l'attrition future. Le DPEM a demandé que l'analyse implique des «familles» de groupes professionnels militaires (GPM) plutôt que les GPM individuellement. Le rapport décrit la méthodologie suivie pour effectuer cette recherche.

La méthodologie est expliquée à l'aide d'un exemple – Les GPM des militaires du rang (MR) liés aux techniques aéronautiques. Ici, les GPM MR de techniques aéronautiques ont été d'abord modélisés individuellement et le taux prévu d'attrition a été pondéré en proportion avec la population de chacun des GPM. Cette façon de faire a donné des résultats bien comparables à ceux obtenus avec le modèle des «familles» de GPM.

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A METHODOLOGY FOR MODELLING FAMILIES OF MILITARY OCCUPATIONS TO FORECAST ATTRITION

I. INTRODUCTION

Background

1. Defence Planning Guidance 2000 (DPG 2000) sets out a number of Human Resource (HR) Change Objectives (COs) and associated goals to guide defence activities over the next five-year planning cycle. [1] Notable amongst these is CO 6 "Career of Choice" which has as its objective:

> "to position Defence as a rewarding, flexible and progressive workplace that builds professional teams of innovative and highly skilled men and women dedicated to accomplishing the mission."

2. Under CO 6, there are HR objectives relating to the development and implementation of a recruitment and retention program that better meets future Defence Team requirements (i.e. CO 6.1). Responsibility for the Canadian Forces (CF) component of this goal has been assigned to the Director General Military Human Resource Policy and Plans (DGMHRPP) by the Assistant Deputy Minister Human Resources - Military, ADM (HR-Mil), Business Plan 2000 call letter [2].

3. The Director Military Employment Policy (DMEP)[1] was named the Project Director for CO 6.1.2 "Retention". This is consistent with a number of retention related issues that DMEP is addressing as part of the Terms of Service (TOS) review. The work plan for the DPG CO 6.1.2 activity includes comprehensive analysis of historical attrition as well as projections of attrition rates to identify potential problems. [3] Recent research published by the Personnel Operational Research Team (PORT) on attrition monitoring and analysis has been used as a reference document for the development of a work plan for this activity. [4] Consequently, PORT was asked by DMEP to support their activity with respect to DPG 2000 CO 6.1.2, primarily by forecasting attrition over the next 10 to 25 years using career flow modelling techniques and historical attrition patterns. [5]

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[1] DMEP was formerly known as the Director Policy Analysis Development (DPAD).

4. PORT career flow models can be employed to make attrition forecasts by simulating the HR policy framework that governs the full life cycle of personnel within the CF. The sets of "modelling rules" which are used to predict future developments within one or more military occupations (MOCs) are based on historical information from the PORT strategic database [6] as well as current demographic and policy input data.

5. In particular, DMEP requires a high level of aggregation for their work. Therefore, it was suggested that the PORT attrition forecasts be carried out within groups of related occupations instead of singly for each MOC. The development and validation of methodology for these new "nest" models is the subject of this paper.

Aim

6. The aim of this paper is to describe the methodology developed by PORT and DMEP to forecast attrition in "nests" of related MOCs in support of DPG 2000 CO 6.1.2 "Retention". Sample results for one such "nest" are included to illustrate the methodology.

Scope

7. This paper describes the career flow modelling methodology developed in co-operation with DMEP to support their analysis of retention in the CF - with possible application to their TOS Review (i.e. the focus is on methodology). Although one particular "nest" of MOCs is used an illustrative example of this approach, other occupations are being modelled in a similar fashion. Many details of model development have been omitted to simplify the discussion. Therefore, interested readers are invited to contact the authors should they require more information in this regard.

Caveats

8. Attrition forecasts obtained through simulation modelling should not be regarded as more than "scientific" guesses obtained through the application of current and historical data, logic and a number of reasoned assumptions. The results may be quite reliable for large populations, but models of occupations that have small populations have higher variability of results. As well, scheduled releases have a high degree of predictability as opposed to voluntary attrition which is harder to predict. Interested readers are referred to a previous PORT study that looks at this intrinsic variability. [7]

9. The example used to illustrate the methodology is the Air Technical Non-Commissioned Member (NCM) "nest". [2] Modelling results included in this paper were produced by making "best fit" assumptions concerning how a family of MOCs would be managed if the individual MOC populations were combined. For the purposes of a "top-down" look at retention on the CF, this may be sufficient but such modelling may not accurately reflect HR policies in sufficient detail to be of use to managing authorities responsible for particular MOCs. Also, modelling results are based on input assumptions developed from the information contained in the PORT strategic desktop computer database. Although this information is regularly reviewed and updated, there is no warranty that these data are completely accurate.

10. Due to time constraints imposed upon the sponsor (and thus upon PORT), insufficient time was available to investigate as many aspects of this study as we would have liked and to conduct a full sensitivity analysis on the results obtained. Although care was taken to obtain accurate data and to check modelling inputs, the results reported here should be regarded as preliminary and in need of review if significantly different assumptions are identified in the future.

II. METHODOLOGY

The Generic Model (GeM) Building Utility

11. Career flow modelling in PORT is mainly accomplished using specific applications of the Generic Model (GeM) utility - a powerful model building environment that was originally developed by the Directorate of Manpower Analysis (D Man A). Originally GeM was developed as a family of executable programs that operated in the OS/2 environment. GeM now operates in the Windows 95 environment using a Graphical User Interface (GUI). The most recent version of GeM incorporates a visual model building environment as well as model execution animations. A number of recent enhancements have been made to "core" GeM models which allow PORT analysts to conduct research into increasingly complex HR policy alternatives.

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[2] See Annex A for a complete list of the proposed officer and NCM "nests" according to MOC.

12. Models developed in the GeM environment capture the influences of the many intricacies of the CF's system of career development such as:

a. controlled ranks;
b. minimum time in rank (TIR) requirements before promotion;
c. contract renewal through the CF Career Development Plan (CFCDP) system of gates;
d. minimum/maximum promotion/intake bounds;
e. compulsory retirement age (CRA); and
f. a variety of entry plans having individualized entry demographics.

13. Career flow modelling of CF occupations, as conducted in GeM, has achieved a great deal of acceptance among personnel planners and career managers. It is a routine part of the analysis supporting occupational restructuring, a tool for investigating the policy alternatives for Annual Military Occupational Reviews (AMORs), and has provided short term guidance in the setting of intake and CFCDP gate levels to meet occupational objectives. Recently, GeM models are being applied to support more strategic policy development [8].

14. Occupational career flow models constructed within the GeM environment are discrete fixed time step simulations. Through user-specified attrition, promotion and intake characteristics, GeM models estimate releases, promotion and intake requirements. They also generate population profiles by various surrogates of military experience such as age, years of service (YOS), years of commissioned service (YCS) for officers, years in occupation for NCMs and TIR. The flow systems represented in these models range from simple career progression to more complex career flow systems involving both feeder and terminal occupations.

Basic Approach to "Nesting"

15. DMEP requires a "top-down" examination of attrition within the CF. Yet attrition is expected to vary according to specific conditions in each occupation - or more properly groups of occupations with similar terms and conditions of employment. Thus, attrition will not in general follow the same pattern in "high tech" fields as it might in "low tech" fields. As a compromise between a "one size fits all" approach and modelling all MOCs individually, DMEP suggested that families of related occupations be grouped together for the purposes of this study. The proposed MOC "nests" are listed in Annex A.

16. To develop career flow models that can handle "nests" of occupations, it is necessary to combine the populations of the MOCs contained in each family. Also, common rules must be developed to represent recruitment, attrition, promotion and contract conversion in the "nest" model for each family. This is accomplished by combining historical information and current HR policies for each of the component occupations into the larger "nest" model. The final value for each item in the GeM list of assumptions (i.e. "rule bases") is computed off-line by summing the contributions for that particular rule from each MOC in the "nest", weighted by the relevant sub-population(s) within the occupations.

17. The above is best illustrated with a simple example. Consider a group of three related occupations that are to be modelled as a single "nest". Say that these MOCs (named A, B and C) have total populations of 200, 300 and 500 members, respectively. Therefore the "nest" can be modelled as a single career flow structure with a population of 1000 who have the combined demographic characteristics of the three MOCs. Data that contain historical attrition, promotion, entry, etc. characteristics for MOC A may contribute 20% of the weight in the new "nest" model rule bases while MOCs B and C contribute 30% and 50%, respectively to this combined "rule base".

18. As an example, consider how to construct the promotion probability from rank n to rank n+1, for eligible personnel (with a particular TIR and YOS) for the new "nest" model when the historical averages for A, B and C are 10%, 10% and 15%, respectively. One way to do this is to sum the respective probabilities and weight the answer by the total population:

(200/1000) * 10% + (300/1000) * 10% + (500/1000) * 15% = 12.5%.

More properly, the relevant populations (i.e. at rank n) should be used instead of the overall population. Therefore, if MOCs A, B and C have populations of 10, 5 and 25 at the rank n, then the "nest" model probability of promotion to rank n+1 would be:

(10/40) * 10% + (5/40) * 10% + (25/40) * 15% = 13.1%.

19. The latter approach is more "accurate" but also more labour intensive, as it must be applied to a multitude of modelling rules including the following:

a. the Preferred Manning Level (PML) for each rank in all time slices (each year in a HR simulation is normally referred to as a time slice) ;
b. intake levels for all time slices (minimum/maximum levels);
c. intake engagement type(s);
d. minimum TIR for promotion according to rank;
e. voluntary attrition rates (based on historical attrition patterns);
f. promotion probabilities as a function of YOS; and
g. CFCDP gates/conversion probabilities.

Model Validation

20. In order to confirm whether or not modelling of MOC "nests" is a valid approach, a validation process was developed which compares this technique with the "brute force" approach. The latter method is merely the development and running of career flow models for each individual MOC in the "nest" and combining results "off-line" in spreadsheets. A detailed example of this validation exercise is described in the next section of this paper.

III. A SAMPLE "NEST" MODEL: THE AIR TECHNICAL NCM OCCUPATIONS

Background

21. The trial occupations selected for detailed analysis and validation are the Air Technical NCM Occupations. The current MOCs in this "nest" are as follows:

a. Aviation Systems Technician - MOC 514 ;
b. Avionics Systems - MOC 526;
c. Aircraft Structures Technician - MOC 565; and
d. Photographic Technician - MOC 541.

22. Historical data required for construction of MOC models for Air Technical NCM occupations must include the following superceded MOCs:

a. Aero Engine Technician - MOC 511;

b. Airframe Technician - MOC 512;
c. Aviation Technician - MOC 513;
d. Integral Systems Technician - MOC 521;
e. Communications and Radar Systems - MOC 524;
f. Avionics Systems Technician - MOC 525;
g. Safety System Technician - MOC 531;
h. Instrument Electrical Technician - MOC 551;
i. Metals Technician - MOC 561;
j. Machinist - MOC 562;
k. Refinisher Technician - MOC 563;
l. Weapons Technician - Air - MOC 571; and
m. Air Weapons Systems Technician - MOC 572.

23. In 1997, the Air Technician NCM occupations were restructured into three MOCs. The Aviation System Technician (MOC 514) was formed from MOCs 511, 512, 513, 531, 551, 571 and 572. The Avionics System Technician (MOC 526) was formed from MOCs 521, 524, 525 and 551. The Aircraft Structure Technician (MOC 565) was formed from the remaining MOCs: 561, 562 and 563. It is worth noting that MOC 551 and 572 technicians were given a choice to convert to either a 514 or 526.

Calculation of Historical Release Rates

24. Release data were extracted from the PORT Strategic Database for the MOCs discussed in this paper and their immediate predecessors. All ranks were combined in this analysis. For each occupation, an annual attrition rate was calculated by dividing all releases in a calendar year by the snapshot population strength at 1 April of the corresponding year. The data corresponded to calendar years 1982 to 1999. Average attrition rates were calculated for each occupation, without using 1994 and 1995 data (i.e. without Forces Reduction Program (FRP) years). Standard deviations of these attrition rates for each occupation were also calculated without using FRP data.

Attrition Forecasts Using Individual MOC Models

25. GeM models for each Air Technical NCM occupation were run using the most current demographic profiles available. Preferred Manning Levels (PMLs) were obtained from the Spring 2000 Personnel Status Report (PSRs) for each occupation. Input attrition rates for individual MOC GeM models were based on historical averages (without using data from FRP years) for each occupation.

26. Specific assumptions are required in order to run each MOC Model and some of these are shown in Annexes B, C, D and E for MOCs 514, 526, 541 and 565 respectively. In particular, historical attrition rates are given for these occupations.

27. GeM model results for each year contain (among many other outputs) total releases and deviations from PML. If any deviations from PML were observed in the results, then this was reflected in the forecast of MOC strength for that year. Forecast total releases for each year (i.e. scheduled and unscheduled) were divided by the forecast MOC strength for that year to obtain the forecast attrition rate for that particular occupation.

Caveat

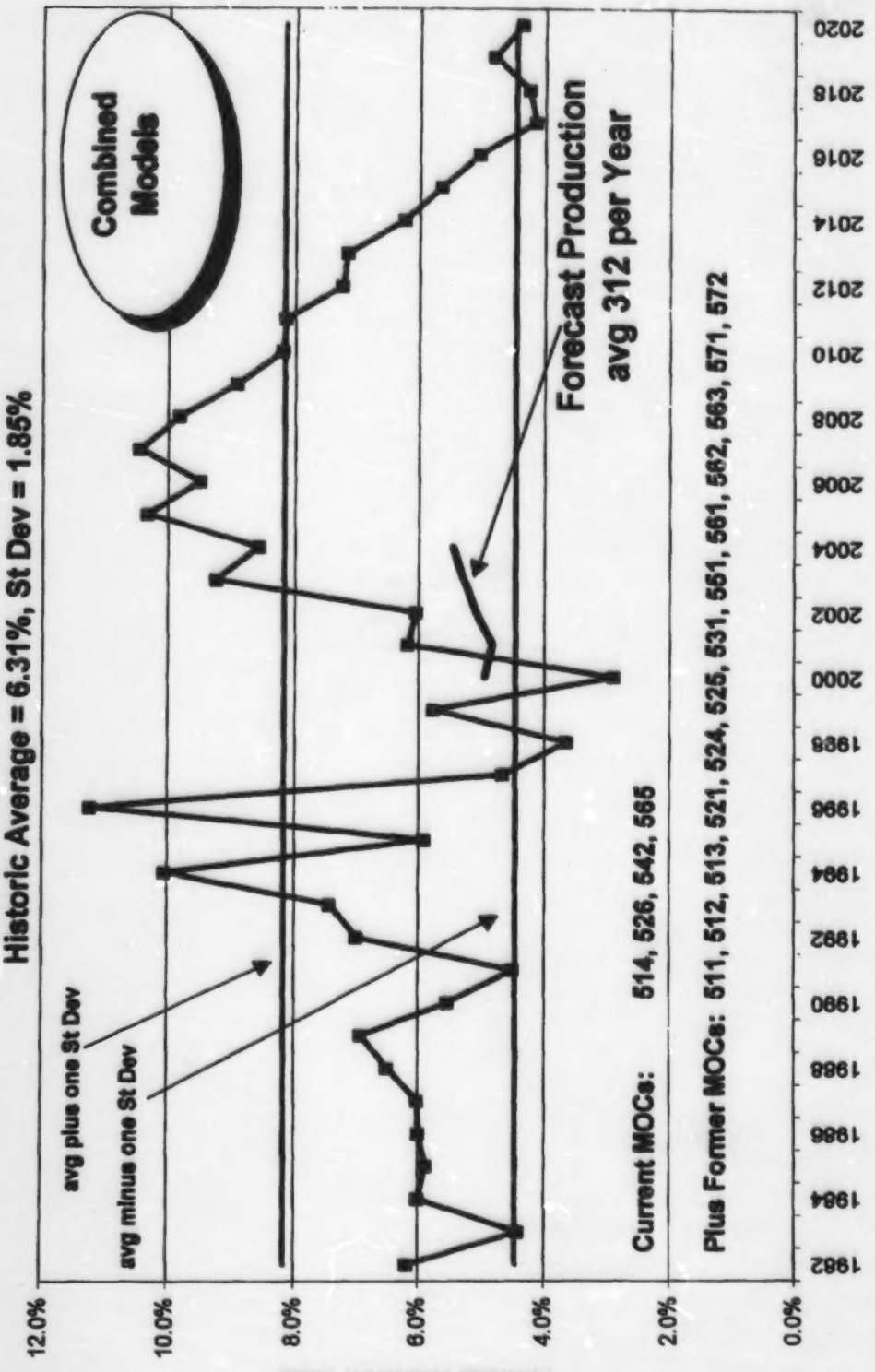
28. The assumptions and results presented here may not contain the level of detail required to support managing authorities responsible for the day-to-day management of these occupations. However, the results are sufficiently representative to effectively demonstrate the intended use of the modelling methodology.

Results - Combining Individual MOC Forecasts

29. The four individual MOC models of the Air Technical NCM "nest" were run separately and the release forecasts for these occupations were combined into one total. The combined attrition rates were then calculated by dividing total releases by the total population of all component MOCs. The results of this analysis are plotted in Figure 1. Results for all ranks and MOCs are combined in this analysis. Over the next 10 years, "above average" attrition is expected for the Air Technical NCM MOCs. The figure also shows the 5 year forecast production for these MOCs and this can be seen to be well below the forecast attrition. Because the models are PML driven, after five years there is a strong possibility that forecast attrition may cause significant recruiting difficulties for the Air Technical NCM MOCs. (This assumes that PML, TOS, production and historical attrition rates all remain fixed after year five of the model.)

30. Historical attrition rates (1982 - 1999) were weighted by the population size of each occupation in the Air Technical NCM MOCs to calculate the average "combined" attrition rate of 6.31%. The standard deviation of the combined Air Technical NCM MOC attrition series is 1.85%.

Figure 1: Air Technical
Non Commissioned Members Attrition for all Ranks



The "Nest" Model Approach

31. A "nest" model all Air Technical NCMs was developed based on the combined populations of the MOCs listed in paragraph 21. The approach taken to develop the GeM inputs required (i.e. PML, Terms of Services gates, strength, historical attrition and promotion patterns) have been discussed previously. Each input was calculated by weighting the individual MOC model inputs by the size of the appropriate population in that MOC at each particular rank.

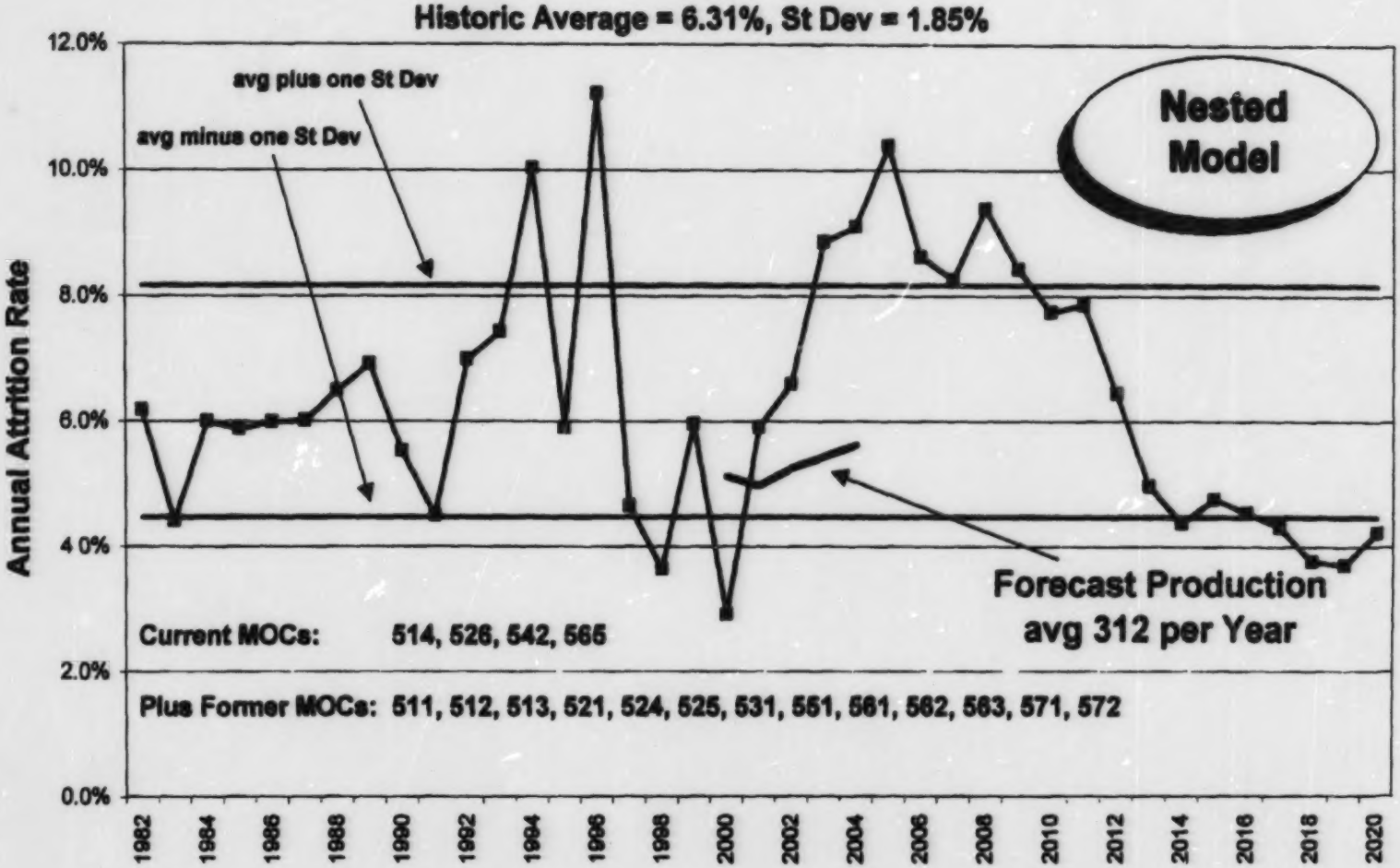
32. Specific assumptions required in order to run the Air Technical NCM "nest" model are shown in Annex F. In particular, the historical attrition rates for the "nest" are computed from the attrition rates given in Annexes B, C, D and E.

Results - "Nest" Model Attrition Forecast

33. Attrition forecasts obtained from running the Air Technical NCM "nest" model are plotted in Figure 2. The 1982 to 1999 points of this graph are historical data and are the same as the corresponding points of Figure 1. As before, results for all ranks are combined in this analysis. The results can be seen to be similar to those obtained by running individual MOC models and combining results, weighting by component population. As before, it is observed that there is a strong possibility there may be sustainment difficulties for the Air Technical NCM MOCs (assuming that PML, TOS, production and historical attrition remain the same after year five of the model).

34. Please note that the historic average attrition in Figure 2 is based on the period 1982 to 1999 and thus is the same as for Figure 1. The standard deviation of the historical attrition rates in the "nest" of Air Technical NCM occupations remains 1.85%.

Figure 2: Air Technical
Non Commissioned Members Attrition for all Ranks



Observations

35. There are few differences between these results shown in Figures 1 and 2. Therefore, for occupational "nests" of this size (i.e. approximately 5000), there appears to be no loss in fidelity by going to the "nest" modelling methodology. Using either approach, the figures demonstrate that in the next 10 years, the Air Technical NCM MOCs will likely experience higher than average attrition rates - although each individual MOC may have different attrition problems. Nevertheless, the overall trend is toward high attrition in this "nest". Only near the end of the modelling horizon (i.e. 20 to 25 years in the future), are these high attrition rates expected to moderate.

36. Looking at individual MOCs, MOC 514 is expected to have the highest attrition rates and these will continue to be high for the next 5 to 7 years. Attrition in MOC 526 is expected to peak in 3 years and continue to be higher than "typical" for the rest of the next decade. There are similar attrition concerns for MOC 541 in the same time period. Also, higher than the average attrition rates are expected for all model years for MOC 565. All of these observations are based on the premise that PML, TOS, production and historical attrition assumptions remain the same after year five in the models.

IV. DISCUSSION

37. There are many pros and cons to modelling occupations in "nests". One advantage to this approach is the smaller number of models needed to cover the entire CF so that subsequent sensitivity analyses are made more efficient. Once a "nest" model is constructed, fewer parameters need to be changed in order to do an "excursion" from the baseline. If the sponsor requires a "top-down" view (as is the case in this study), then the high aggregation of MOCs can be seen as a simplification for analysis purposes. In particular, some occupational families have complex career flow patterns which need not (and cannot) be reproduced in detail for this type of approach. Thus, by adopting a "straight up and down" rank flow structure, a "nest" model may be simpler conceptually than the component MOCs in some cases (e.g. medical NCMs, construction engineering NCMs). In terms of the DMEP-sponsored attrition study, "nest" models support a more comprehensive set of measures than individual MOC models. (The sponsor requested demographic characteristics of releases and estimates of the number of contracts that expire in the near future. These measures are within standard

limits of the "nest" modelling approach but cannot be supported in the current version of GeM.)

38. A disadvantage of the "nest" modelling approach is that specific (i.e. new) models must be constructed when there are often individual MOC models already available in PORT's inventory. These new "nest" models may have no further use once this particular study is completed, while there is sure to be a requirement for individual MOC models at a later date. The trade-off between the time lost in building new "nest" models and the time gained during the analysis phase (say for excursions from the baseline assumptions) is not clear. Another concern is the possible "submerging" of problems in one or more MOCs when these occupations are examined indirectly as part of a larger "nest". In spite of the desire to be strategic, these individual MOC problems may have a significant effect on decision-makers (e.g. pilot attrition).

39. Can "nest" models be validated? This paper has demonstrated that attrition forecasts obtained from a "nest" model are comparable with those obtained by running individual models and summing results "off-line" using a weighted average approach. However, the large populations of these occupations have the effect of reducing variability in modelling results. [7] The validity of small "nest" models remains to be demonstrated.

V. SUMMARY AND CONCLUDING REMARKS

40. In conjunction with the DPG 2000 Change Objective 6.1, DMEP requested that DSHRC carry out a historical analysis of military attrition and forecast what attrition is likely to be in the future. The sponsor requires aggregated attrition forecasts in related families (i.e. "nests") of occupations in order to examine various employment (terms of service) policies and their implications for the CF.

41. This paper outlines a proposed methodology for constructing "nest" models to satisfy this particular sponsor request. In addition, the paper provides a detailed example of how this particular methodology might be applied - the Air Technical NCM family of occupations. Individual MOC models for these occupations were run and the results combined (in a weighted average) in order to validate the results obtained from the "nest" model. Since the attrition forecasts are comparable with either approach, it

can be concluded that "nest" models provide a reasonable alternative to the "brute force" approach of modelling all occupations individually. The Air Technical NCM "nest" has a large population and this helps to ensure that modelling results are "stable". The applicability of this approach to smaller populations remains to be demonstrated.

42. The "nest" modelling approach should provide sufficient information on strategic attrition patterns within the CF to assist HR decision-makers with their assessment of the nature of the possible retention problem facing them. Interim modelling results (for a number of "nests") based on this methodology have already been made available to DMEP as they prepare for their presentation to the Armed Forces Council (AFC).

43. Modelling results for this particular "nest" suggest that the Air Technical NCM occupations may be expected to have attrition rates that exceed historical averages over the next decade.

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ANNEX A
TO DOR(CAM) RN 2000/03
DATED JUNE 2000

FAMILIES OF RELATED OCCUPATIONS FOR THE DMEP ATTRITION STUDY

1. DMEP suggested that PORT model CF occupations in groups of related occupations. This annex contains a tentative list of groupings of military occupations as suggested by DMEP. The composition of these groups is expected to change following a thorough review with the sponsor and other stakeholders.

General Officers	Code	Occupation
	11	General Officer
	12	General Officer - Specialist

Land Combat Arms Officers	Code	Occupation
	21	Armour
	22	Artillery
	23	Infantry
	24	Engineer

Land Combat Arms NCMs	Code	Occupation
	011	Crewman
	021	Artillery Field
	022	Artillery Air Defence
	031	Infantry
	041	Field Engineer
	042	Field Engineer Equipment Operator

Sea Combat Arms/General Officers	Code	Occupation
	71	Maritime Surface and Sub-surface

Sea Combat Arms/General NCMs	Code	Occupation
	085	Naval Weapons Technician
	181	Boatswain
	275	Naval Combat Information Operator
	276	Naval Electronics System Operator
	277	Naval Communicator
	278	Naval Acoustic Sensor Operator
	283	Naval Electronics Technician - Acoustic
	284	Naval Electronics Technician - Comms
	285	Naval Electronics Technician - Tactical
	286	Naval Electronics Technician - Manager
	341	Clearance Diver
	342	Clearance Diver Technician

Sea Technical Officers	Code	Occupation
	44	Maritime Engineer

Sea Technical NCMs	Code	Occupation
	312	Maritime Engineering Mechanic
	313	Maritime Engineering Technician
	314	Maritime Engineering Artificer
	321	Hull Technician
	331	Electrical Technician
	332	Marine Electrician

Flight Crew Officers	Code	Occupation
	31	Navigator
	32	Pilot
	39	Aerospace Control

Flight Crew NCMs	Code	Occupation
	081	Airborne Electronic Sensor
	091	Flight Engineer
	131	Search and Rescue Technician

Air General Officers	Code	Occupation
	46	Airfield Engineer

Air General NCMs	Code	Occupation
	121	Meteorological Technician
	168	Aerospace Control Operator

Air Technical Officers	Code	Occupation
	41	Aerospace Engineer

Air Technical NCMs	Code	Occupation
	514	Aviation Systems Technician
	526	Avionics Systems
	565	Aircraft Structures Technician
	541	Photographic Technician

Engineering Officers	Code	Occupation
	45	Military Engineer

Engineering NCMs	Code	Occupation
	641	Refrigeration and Mechanical Technician
	642	Electrical Distribution Technician
	643	Electrical Generating Systems
	646	Plumbing and Heating Technician
	647	Water Fuel and Environment Technician
	648	Construction Technician
	649	Construction Engineering Superintendent
	052	Lineman
	651	Firefighter
	142	Geomatics Technician

Electronics & Communications Officers	Code	Occupation
	42	Communications and Electrical Engineer

Electronics & Communications NCMs	Code	Occupation
	211	Radio Operator
	212	Teletype Operator
	225	Strategic Information Systems
	226	Aerospace Telecommunications
	227	Land Communications
	291	Communications Research

Medical Officers	Code	Occupation
	48	Health Care Administration
	49	Physical Therapy
	51	Dental
	52	Health Services Operations
	54	Pharmacy
	55	Medical
	56	Medical Associate Officer
	57	Nurse
	58	Social Work

Medical Officers	Code	Occupation
	711	Medical Assistant
	713	Operating Room Technician
	714	Medical Lab Technician
	715	X-Ray Technician
	716	Preventive Medicine Technician
	718	Biomedical Electronic Technician
	719	Health Services Technical Manager
	731	Aeromedical Technician
	722	Dental Clinical Assistant
	725	Dental Hygienist

Logistics Officers	Code	Occupation
	69	Logistics

Logistics NCMs	Code	Occupation
	921	Ammunition Technician
	861	Cook
	862	Steward
	911	Supply Technician
	933	Traffic Technician
	935	Mobile Support Equipment Operator
	836	Resource Management Support Clerk

Administration Officers	Code	Occupation
	68	Personnel Administration
	76	Postal

Administration NCMs	Code	Occupation
	881	Postal Clerk

Specialist Officers	Code	Occupation
	61	Chaplain - Protestant
	62	Chaplain - Roman Catholic
	66	Public Affairs
	67	Legal
	72	Personnel Selection
	74	Training Development
	75	Music

Specialist NCMs	Code	Occupation
	833	Court Reporter
	871	Musician

Security/Intelligence Officers	Code	Occupation
	81	Security Officer
	82	Intelligence Officer

Security/Intelligence NCMs	Code	Occupation
	811	Military Police
	111	Intelligence Operator

ANNEX B
TO DOR(CAM) RN 2000/03
DATED JUNE 2000

MOC 514 MODEL ASSUMPTIONS

Table B-I
MOC 514 Initial Staff & PML Distribution

Rank	Current Staff	PML	Difference
PTE/CPL	2171	1754	417
MCPL	816	801	15
SGT	402	369	33
WO	162	163	-1
MWO	99	99	0
CWO	40	34	6

Table B-II
MOC 514 Future PML Targets (Spring 2000 PSR)

Year	CWO	MWO	WO	SGT	MCPL	PTE/ CPL	TOTAL
2000	34	99	163	369	801	1754	3220
2001	39	104	158	369	798	1716	3184
2002	38	104	158	369	797	1715	3181
etc..	38	104	158	369	797	1715	3181

Table B-III
MOC 514 Intake / Recruitment

Production		Production Ratio	
		Basic Recruit	LOTP
2000	168	80%	20%
2001	163	80%	20%
2002	163	80%	20%
2003	163	80%	20%
2004	163	80%	20%
Thereafter	PML Driven	The Same	The Same

Table B-IV

MOC 514 Model Voluntary Attrition Rates by Rank

(Probability of Unscheduled Release at a YOS level)

YOS	PTE	CPL	MCPL	SGT	WO	MWO	CWO
1	0.03	0	0	0	0	0	0
2	0.02	0	0	0	0	0	0
3	0.04	0.05	0	0	0	0	0
4	0.03	0.03	0	0	0	0	0
5	0	0.03	0	0	0	0	0
6	0	0.03	0.01	0	0	0	0
7	0	0.02	0.03	0	0	0	0
8	0	0.02	0.02	0	0	0	0
9	0	0.02	0.03	0	0	0	0
10	0	0.02	0.02	0.06	0	0	0
11	0	0.02	0.02	0.01	0	0	0
12	0	0.02	0.01	0.02	0	0	0
13	0	0.01	0.01	0.01	0	0	0
14	0	0.01	0.01	0	0	0	0
15	0	0.02	0.01	0.01	0	0	0
16	0	0.02	0.01	0.01	0	0	0
17	0	0.01	0.01	0	0	0	0
18	0	0.02	0	0	0.01	0	0
19	0	0.06	0.06	0.02	0.05	0.04	0
20	0	0.13	0.05	0.04	0.03	0.06	0
21	0	0.13	0.06	0.03	0.04	0.03	0
22	0	0.13	0.09	0.02	0.02	0.06	0
23	0	0.13	0.11	0.04	0.06	0.05	0.14
24	0	0.38	0.24	0.07	0.07	0.06	0
25	0	0.33	0.16	0.09	0.07	0.1	0.2
26	0	0.22	0.1	0.08	0.05	0.07	0
27	0	0.23	0.17	0.06	0.07	0.03	0.09
28	0	0.17	0.14	0.09	0.1	0.07	0.09
29	0	0.23	0.23	0.21	0.14	0.11	0.08
30	0	0.59	0.25	0.25	0.14	0.1	0.05
31	0	0.5	0.39	0.26	0.21	0.16	0.05
32	0	0.56	0.37	0.3	0.21	0.15	0.18
33	0	0.33	0.37	0.17	0.19	0.15	0.09
34	0	0	0.44	0.02	0.17	0.24	0.16
35	0	0.33	0	0.26	0.26	0.23	0.18
36	0	1	0.33	0.19	0.3	0.26	0.14

ANNEX C
TO DOR(CAM) RN 2000/03
DATED JUNE 2000

MOC 526 MODEL ASSUMPTIONS

Table C-I
MOC 526 Initial Staff & PML Distribution

Rank	Current Staff	PML	Difference
PTE/CPL	932	786	146
MCPL	481	489	-8
SGT	201	212	-11
WO	106	109	-3
MWO	49	45	4
CWO	15	16	-1

Table C-II
MOC 526 Future PML Targets (Spring 2000 PSR)

Year	CWO	MWO	WO	SGT	MCPL	PTE/ CPL	TOTAL
2000	16	45	109	212	489	786	1657
2001	15	49	107	198	432	761	1560
2002	15	48	106	196	430	759	1554
etc..	15	48	106	196	430	759	1554

Table C-III
MOC 526 Intake / Recruitment

Production		Production Ratio	
		Basic Recruit	LOTP
2000	96	80%	20%
2001	96	80%	20%
2002	109	80%	20%
2003	109	80%	20%
2004	109	80%	20%
Thereafter	PML Driven	The Same	The Same

Table C-IV

MOC 526 Model Voluntary Attrition Rates by Rank

(Probability of Unscheduled Release at a YOS level)

YOS	PTE	CPL	MCPL	SGT	WO	MWO	CWO
1	0.03	0	0	0	0	0	0
2	0.01	0	0	0	0	0	0
3	0.02	0.09	0	0	0	0	0
4	0.05	0.03	0	0	0	0	0
5	0	0.03	0.07	0	0	0	0
6	0	0.03	0.04	0	0	0	0
7	0	0.03	0.04	0	0	0	0
8	0	0.03	0.03	0	0	0	0
9	0	0.02	0.03	0	0	0	0
10	0	0.02	0.03	0.02	0	0	0
11	0	0.01	0.03	0.02	0	0	0
12	0	0.01	0.01	0	0	0	0
13	0	0.01	0.01	0.01	0	0	0
14	0	0.01	0.01	0.01	0	0	0
15	0	0.01	0.01	0.01	0	0	0
16	0	0.01	0.01	0	0	0	0
17	0	0.01	0	0	0	0	0
18	0	0.04	0.01	0	0	0	0
19	0	0.12	0.07	0.02	0.02	0	0
20	0	0.14	0.07	0.04	0.07	0.05	0
21	0	0.2	0.06	0.04	0.03	0	0
22	0	0.11	0.05	0.04	0.04	0.02	0.67
23	0	0.13	0.1	0.05	0.04	0.06	0
24	0	0.17	0.14	0.1	0.09	0.04	0
25	0	0.15	0.12	0.07	0.09	0.05	0.08
26	0	0.19	0.14	0.06	0.08	0.06	0
27	0	0.47	0.13	0.08	0.08	0.09	0
28	0	0.2	0.14	0.11	0.11	0.06	0.06
29	0	0.3	0.27	0.18	0.09	0.1	0.11
30	0	0.38	0.37	0.2	0.15	0.14	0.02
31	0	0.67	0.49	0.29	0.2	0.13	0.09
32	0	0.67	0.42	0.19	0.13	0.16	0.11
33	0	0.5	0.25	0.14	0.1	0.19	0.21
34	0	0	0.33	0.11	0.13	0.14	0.16
35	0	0	0.17	0.25	0.1	0.25	0.19
36	0	0	0	0.29	0.17	0.15	0.33

ANNEX D
TO DOR(CAM) RN 2000/03
DATED JUNE 2000

MOC 541 MODEL ASSUMPTIONS

Table D-I
MOC 541 Initial Staff & PML Distribution

Rank	Current Staff	PML	Difference
PTE/CPL	115	101	14
MCPL	49	47	2
SGT	39	40	-1
WO	8	9	-3
MWO	7	6	1
CWO	3	2	1

Table D-II
MOC 541 Future PML Targets (Spring 2000 PSR)

Year	CWO	MWO	WO	SGT	MCPL	PTE/ CPL	TOTAL
2000	2	6	9	40	47	101	205
2001	3	7	8	41	56	102	217
2002	3	7	8	42	56	102	218
etc..	3	7	8	42	56	102	218

Table D-III
MOC 541 Intake / Recruitment

Production		Production Ratio	
		Basic Recruit	LOTP
2000	20	80%	20%
2001	10	80%	20%
2002	10	80%	20%
2003	10	80%	20%
2004	10	80%	20%
Thereafter	PML Driven	The Same	The Same

Table D-IV

MOC 541 Model Voluntary Attrition Rates by Rank

(Probability of Unscheduled Release at a YOS level)

YOS	PTE	CPL	MCPL	SGT	WO	MWO	CWO
1	0.07	0	0	0	0	0	0
2	0.04	0	0	0	0	0	0
3	0.05	0.07	0	0	0	0	0
4	0	0.04	0	0	0	0	0
5	0	0.04	0	0	0	0	0
6	0	0.07	0	0	0	0	0
7	0	0.04	0.05	0	0	0	0
8	0	0.02	0.02	0	0	0	0
9	0	0.03	0.03	0	0	0	0
10	0	0.02	0.03	0	0	0	0
11	0	0.04	0.03	0	0	0	0
12	0	0.02	0.05	0	0	0	0
13	0	0.01	0.02	0	0	0	0
14	0	0.03	0.01	0	0	0	0
15	0	0.02	0.02	0.04	0	0	0
16	0	0	0.01	0.02	0.2	0	0
17	0	0.02	0	0	0	0	0
18	0	0.02	0	0	0	0	0
19	0	0.19	0.11	0.05	0.05	0	0
20	0	0.08	0.11	0.03	0.05	0	0
21	0	0	0.14	0.04	0.05	0	0
22	0	0.2	0	0.03	0	0	0
23	0	0.17	0	0.04	0.14	0	0
24	0	0.5	0.43	0.07	0.16	0	0
25	0	0.33	0	0.06	0.08	0.1	0.33
26	0	0	0.17	0.03	0.08	0.17	0
27	0	0	0	0.09	0.24	0	0
28	0	0	0.25	0.07	0.05	0.07	0
29	0	0	0.67	0.25	0.19	0	0
30	0	0.5	0.5	0.2	0.13	0.17	0.17
31	0	0	0	0.25	0.17	0.11	0.17
32	0	0	0	0	0.2	0.11	0
33	0	0	1	0	0	0.4	0.17
34	0	0	0	0	0.5	0.25	0
35	0	0	0	1	0	0	0.33
36	0	0	0	0	0	1	0.5

ANNEX E
TO DOR(CAM) RN 2000/03
DATED JUNE 2000

MOC 565 MODEL ASSUMPTIONS

Table E-I
MOC 565 Initial Staff & PML Distribution

Rank	Current Staff	PML	Difference
PTE/CPL	341	292	49
MCPL	93	104	-11
SGT	49	49	0
WO	21	19	2
MWO	6	7	-1
CWO	6	4	2

Table E-II
MOC 565 Future PML Targets (Spring 2000 PSR)

Year	CWO	MWO	WO	SGT	MCPL	PTE/ CPL	TOTAL
2000	4	7	19	49	104	292	475
2001	5	8	19	48	99	285	464
2002	5	8	19	48	100	285	465
etc..	5	8	19	48	100	285	465

Table E-III
MOC 565 Intake / Recruitment

Production		Production Ratio	
		Basic Recruit	LOTP
2000	30	80%	20%
2001	33	80%	20%
2002	33	80%	20%
2003	33	80%	20%
2004	33	80%	20%
Thereafter	PML Driven	The Same	The Same

Table E-IV

MOC 565 Model Voluntary Attrition Rates by Rank

(Probability of Unscheduled Release at a YOS level)

YOS	PTE	CPL	MCPL	SGT	WO	MWO	CWO
1	0.03	0	0	0	0	0	0
2	0.02	0	0	0	0	0	0
3	0.06	0.17	0	0	0	0	0
4	0	0.05	0	0	0	0	0
5	0.33	0.05	0	0	0	0	0
6	0	0.05	0	0	0	0	0
7	0	0.02	0	0	0	0	0
8	0	0.04	0.11	0	0	0	0
9	0	0.01	0.03	0	0	0	0
10	0	0.04	0.02	0	0	0	0
11	0	0.04	0.02	0	0	0	0
12	0	0.04	0.04	0	0	0	0
13	0	0.02	0.04	0	0	0	0
14	0	0.01	0.01	0.03	0	0	0
15	0	0	0.01	0	0.11	0	0
16	0	0.03	0.01	0	0	0	0
17	0	0.04	0	0	0	0	0
18	0	0	0.01	0	0	0	0
19	0	0.14	0.13	0.1	0.06	0	0
20	0	0.13	0.2	0.07	0	0.5	0
21	0	0.03	0.13	0.08	0.06	0.25	0
22	0	0.11	0.18	0.09	0.12	0	0
23	0	0.2	0.27	0.14	0.06	0.13	0
24	0	0.37	0.41	0.18	0.11	0.1	0
25	0	0.25	0.18	0.22	0.22	0.05	0
26	0	0.06	0.04	0.25	0.14	0.06	0
27	0	0.07	0.25	0.25	0.19	0.26	0
28	0	0.08	0.17	0.24	0.31	0.06	0
29	0	0.25	0.22	0.11	0.25	0.06	0.3
30	0	0.25	0.6	0.29	0.17	0.13	0.22
31	0	0	0.6	0.5	0.4	0.31	0
32	0	0.67	1	0.4	0	0.29	0
33	0	0	0	0	0.33	0.6	0.63
34	0	0	0	0	0	1	0
35	0	0	0	0	1	0	0.33
36	0	0	0	0	0	0	0.5

ANNEX F
TO DOR(CAM) RN 2000/03
DATED JUNE 2000

AIR TECHNICAL NCM "NEST" MODEL ASSUMPTIONS

Table F-I
Air Technical NCM "Nest" Initial Staff & PML Distribution

Rank	Current Staff	PML	Difference
PTE/CPL	3437	2933	504
MCPL	1394	1441	-47
SGT	662	670	-8
WO	286	300	-14
MWO	159	157	2
CWO	62	56	6

Table F-II
Air Technical NCM "Nest" Future PML Targets (from Spring 2000 PSR)

Year	CWO	MWO	WO	SGT	MCPL	PTE/ CPL	TOTAL
2000	56	157	300	670	1441	2933	5557
2001	62	168	292	654	1385	2864	5425
2002	61	167	291	655	1383	2861	5418
etc..	61	167	291	655	1383	2861	5418

Table F-III
Air Technical NCM "Nest" Intake / Recruitment

Production		Production Ratio	
		Basic Recruit	LOTP
2000	314	80%	20%
2001	302	80%	20%
2002	315	80%	20%
2003	315	80%	20%
2004	315	80%	20%
Thereafter	PML Driven	The Same	The Same

Table F-IV

Air Technical "NEST" Model Voluntary Attrition Rates by Rank

(Percentage of Population at a YOS level)

YOS	PTE	CPL	MS	PO2	PO1	CPO2	CPO1
1	0.03	0.00	0.00	0.00	0.00	0.00	0.00
2	0.02	0.00	0.00	0.00	0.00	0.00	0.00
3	0.04	0.07	0.00	0.00	0.00	0.00	0.00
4	0.03	0.03	0.00	0.00	0.00	0.00	0.00
5	0.06	0.03	0.02	0.00	0.00	0.00	0.00
6	0.00	0.03	0.02	0.00	0.00	0.00	0.00
7	0.00	0.02	0.03	0.00	0.00	0.00	0.00
8	0.00	0.02	0.03	0.00	0.00	0.00	0.00
9	0.00	0.02	0.03	0.00	0.00	0.00	0.00
10	0.00	0.02	0.02	0.04	0.00	0.00	0.00
11	0.00	0.02	0.02	0.01	0.00	0.00	0.00
12	0.00	0.02	0.01	0.01	0.00	0.00	0.00
13	0.00	0.01	0.01	0.01	0.00	0.00	0.00
14	0.00	0.01	0.01	0.01	0.00	0.00	0.00
15	0.00	0.02	0.01	0.01	0.01	0.00	0.00
16	0.00	0.02	0.01	0.01	0.01	0.00	0.00
17	0.00	0.01	0.01	0.00	0.00	0.00	0.00
18	0.00	0.02	0.00	0.00	0.01	0.00	0.00
19	0.00	0.09	0.07	0.03	0.04	0.02	0.00
20	0.00	0.13	0.07	0.04	0.04	0.07	0.00
21	0.00	0.14	0.07	0.04	0.04	0.03	0.00
22	0.00	0.13	0.08	0.03	0.03	0.04	0.16
23	0.00	0.14	0.11	0.05	0.06	0.05	0.09
24	0.00	0.33	0.22	0.09	0.08	0.05	0.00
25	0.00	0.28	0.14	0.09	0.09	0.08	0.16
26	0.00	0.19	0.11	0.08	0.07	0.07	0.00
27	0.00	0.27	0.16	0.08	0.09	0.06	0.06
28	0.00	0.16	0.15	0.11	0.12	0.07	0.07
29	0.00	0.24	0.26	0.20	0.13	0.10	0.10
30	0.00	0.50	0.32	0.24	0.15	0.12	0.06
31	0.00	0.48	0.42	0.29	0.22	0.15	0.06
32	0.00	0.58	0.41	0.26	0.17	0.16	0.14
33	0.00	0.34	0.33	0.14	0.16	0.19	0.17
34	0.00	0.00	0.36	0.04	0.15	0.24	0.14
35	0.00	0.20	0.06	0.28	0.25	0.22	0.20
36	0.00	0.61	0.19	0.19	0.22	0.25	0.24

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As Project Director for the retention portion of the Defence Planning Guidance (DPG) Change Objective 6.1 "Recruitment and Retention", the Director Military Employment Policy (DMEP) requested that DSHRC carry out a historical analysis of military attrition and forecast what attrition is likely to be in the future. DMEP requested that the analysis be conducted in "nests" of related military occupations (MOCs) rather than by individual MOC. This report describes the methodology being used for this study.

The methodology is illustrated with an example - the Air Technical Non Commissioned Member (NCM) MOCs. In this example, the Air Technical NCM MOCs were first modelled individually and the attrition forecasts combined by weighting them in proportion to the population of each component MOC. These results compare favourably with those obtained by using a "nest" model approach.

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